Metal-Insulator Transition in Vanadium Oxide Nanowires

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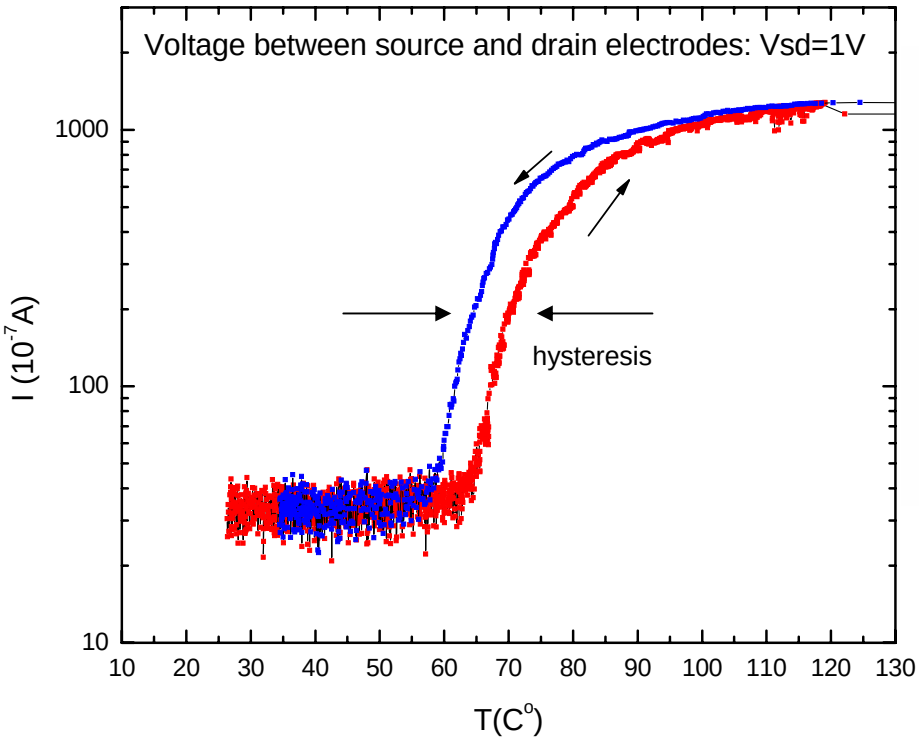
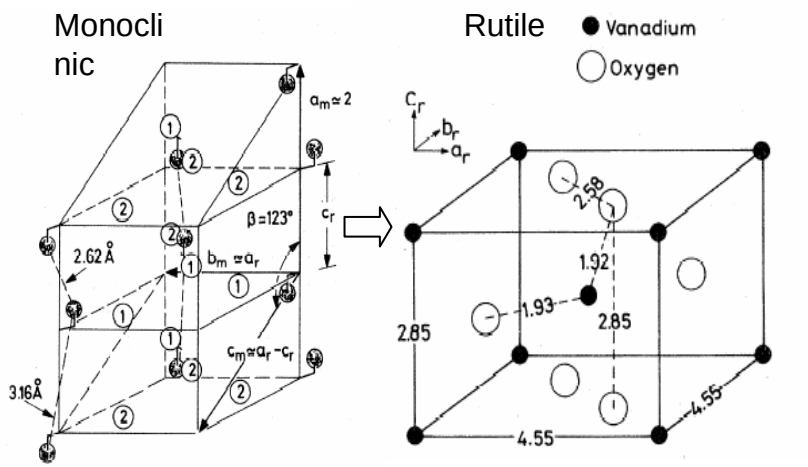
Why Vanadium Oxides

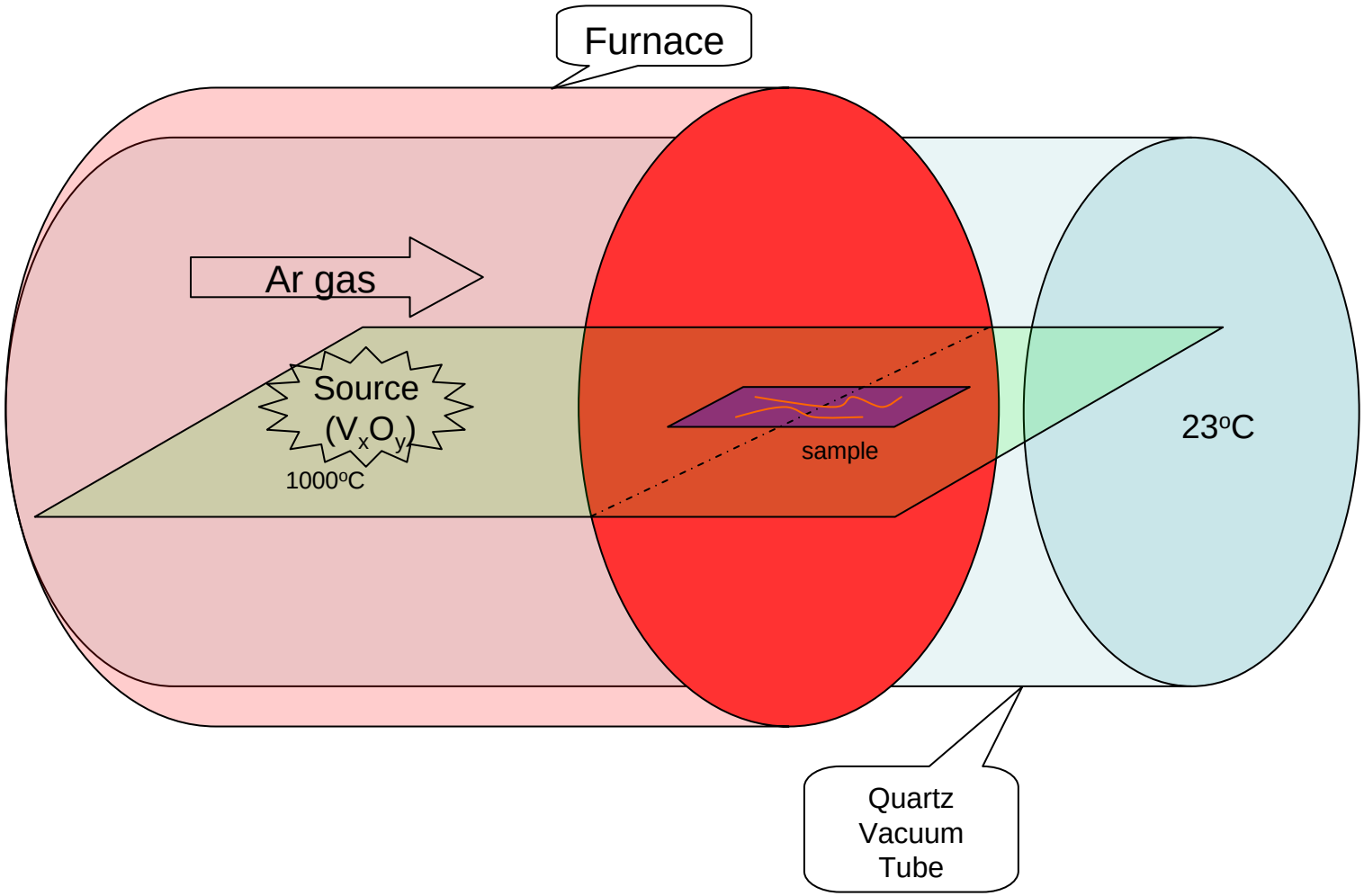




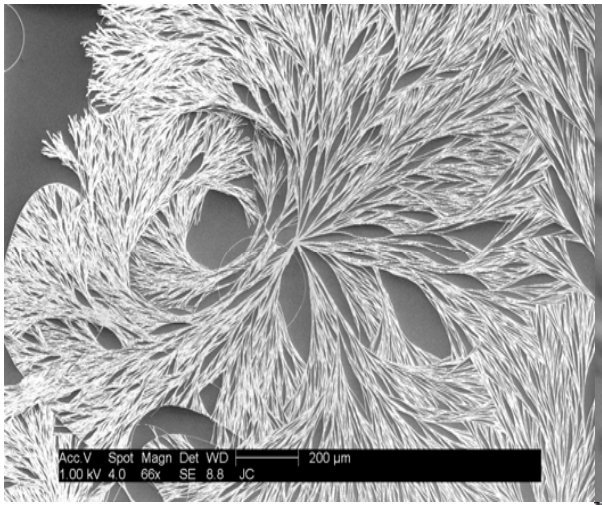
VO_2 shows Monoclinic structure (left) *below* transition temperature, and rutile structure (right) *above* transition temperature.

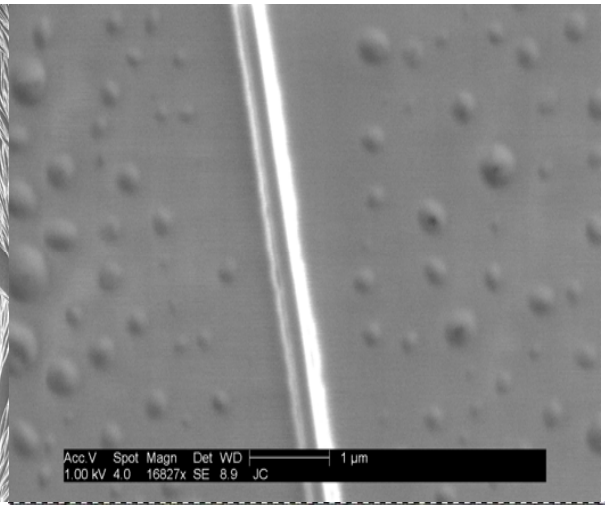
The current or conductance of the VO_2 film increases, as temperature increases, with several orders of magnitude.

VOx Nanowire Growth



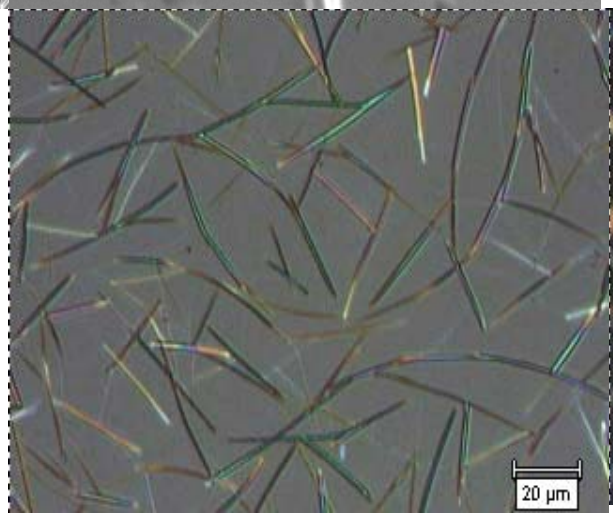
Grown Nanowires

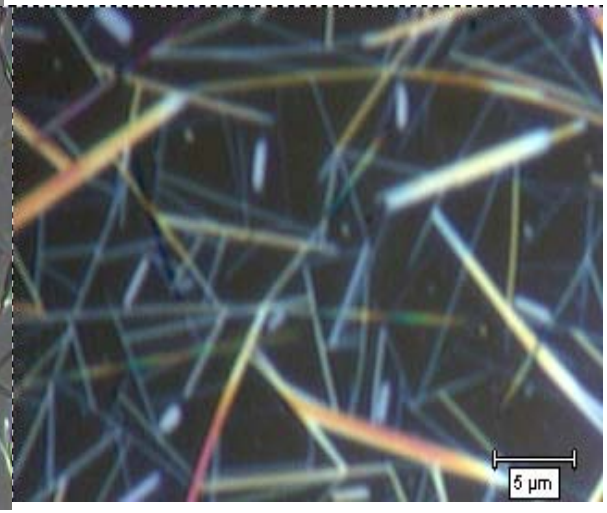




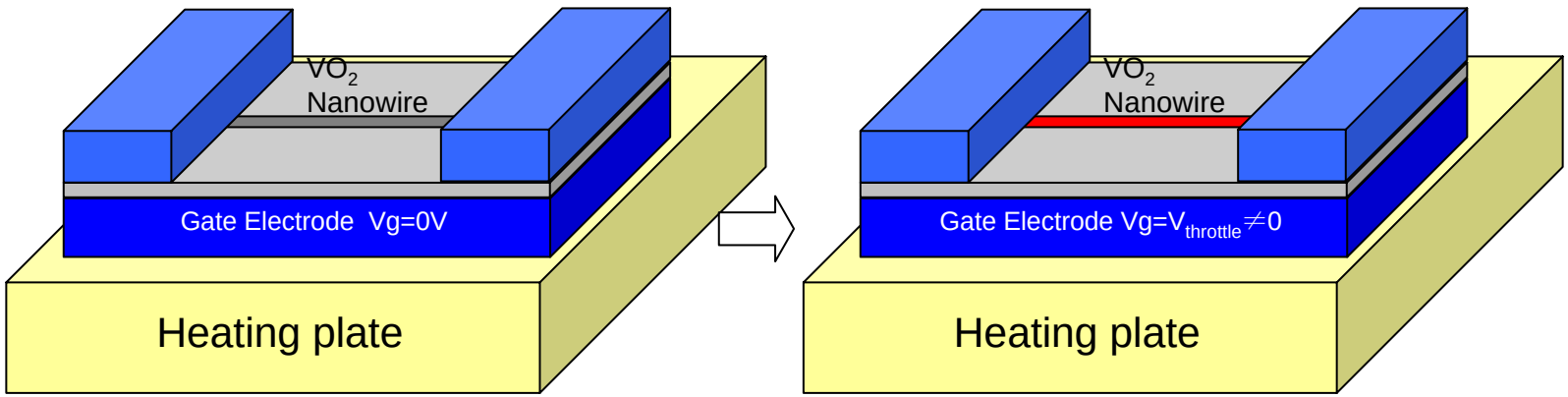
SEM images of V_2O_5 nanowires, which show some strange growth pattern.

Some optical images of VO_2 nanowires. Notice that the thickness of the wires varies greatly.



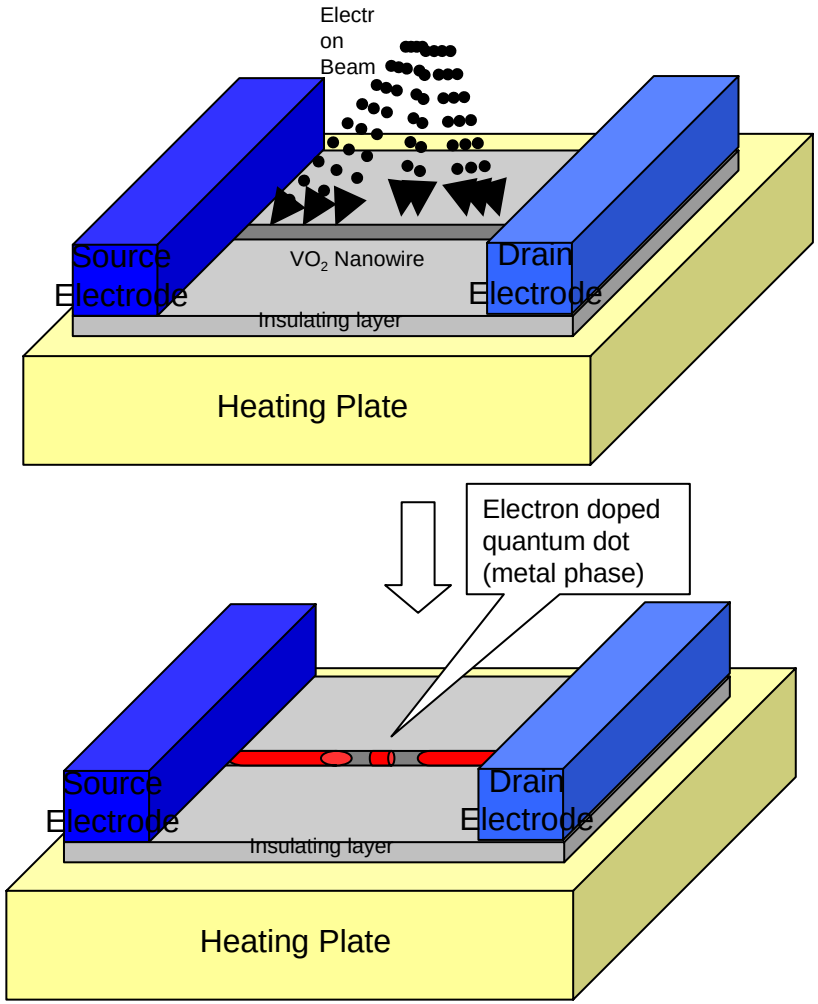


Measurement



A schematic diagram of a vanadium oxide nanowire field effect transistor (FET). For VO_2 nanowires near transition temperature 68ºC, the phase transition is expected to be triggered by an electric field from the gate electrode.

Measurement



A schematic diagram of a VO_2 quantum dot.

VO_2 nanowire insulator phase could be permanently changed to metallic phase by exposed to high-energy beam.

By selectively making different segments along the nanowire conductive or nonconductive, we can make a quantum dot and study the phase transition in it.